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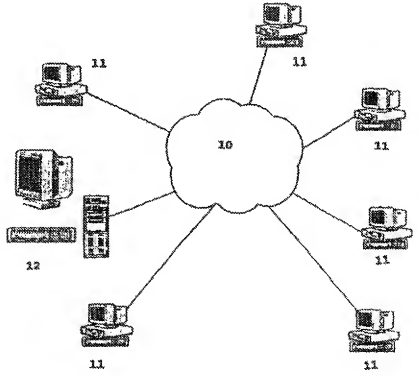
(57) Abstract

A method of managing a plurality of computer workstations interconnected by a network, the workstations including at least one policy group. The method includes the steps of receiving data relating to the policy group definition and generating a program representative of the policy group definition data. The generated program is sent to each of the plurality of workstations and the workstations instructed to check, by employing the program, whether or not each respective workstation belongs or does not belong to the at least one policy groups. The results of the checking step from each work station are returned to at least one managing station.



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MANAGEMENT OF COMPUTER WORKSTATIONS

The subject of this application is concerned with modern networks of computers. With the advent of reliable Local Area Networks (LANs) and good quality Wide Area Networks (WANs) it has been possible to interconnect low cost powerful personal computers and file / print server equipment. Such networks of computers have grown very quickly in recent years so that it is not uncommon to find networks ranging from thousands to tens of thousands of computer (nodes) all within the same commercial organisation. Companies usually develop such networks to cover a number of main sites which will be served by LANs and interconnected via WAN links.

This structure is in marked contrast to the structure of data networks of 10 years ago where computer terminals were connected directly (or via concentrators) to one or a very few large mainframe computers.

Not only does this change represent a major difference in technology, but it also gives rise to differences in operating principles. In the old mainframe case, all services were provided and controlled centrally from the company's IT and Operations departments; whereas now there is a strong tendency to decentralise and for individual departments become responsible for their own workstation PCs. In any event, no central control is implied or (usually) imposed on LANs and their connected systems.

Management systems for controlling the network infrastructure of LAN/WAN networks are frequently to be found but to date, few (if any) of these address the problem of managing workstations and their servers (fig 1). A major problem comes about from the fact that each PC is independent of the others and thus may be configured differently and without reference to them. Each may contain different software suites as well as different hardware. However, since they are all using a common data infrastructure (the LAN/WAN) these differences can give

rise to conflicts on data accesses. Furthermore, since no one authority is responsible for all the PCs, no-one can guarantee that software licence provisions are being strictly adhered to.

The resolution of these problems implies being able to define inventory classes (for groups of computers) and being able to monitor them on a continuous basis. Added to this is the problem of making changes and updates to such groups of computers as they are found to require it. The actual groupings specified will need to reflect the operational as well as organisational nature of each company concerned. In effect network administrators have to be able to define and redefine them as a company's needs change.

According to the present invention, there is provided a method of managing a plurality of computer workstations interconnected by a network, the workstations including at least one policy group, the method including the steps of:

receiving data relating to the policy group definition;

generating a program representative of the policy group definition data;

sending the generated program to each of the plurality of workstations;

instructing the workstations to check, by employing the program, whether or not each respective workstation belongs or does not belong to the at least one policy group; and

returning the results of the checking step form each work station to at least one managing station.

This invention solves the above problems firstly by allowing the network administrator (i.e. the user of the network management system) to be able to define the membership conditions corresponding to each group which he wishes to create, and then to have them sent to all of the workstations on the network as a script or program data for execution within each agent locally. At this point, (the

agent residing in) each workstation will check periodically whether or not it fulfils any group membership and if so it will transmit a trap or event message to the network management station. This in turn on receiving these traps will update its database to reflect this. Thus, since the membership of each group is checked independently by each workstation, the effect is one of producing an inventory in real time of network status. Policies can therefore be managed with an assurance of accurate and timely information.

The novelty of the above approach is in respect of the fact that the decisions for group membership are taken by each workstation itself and independently of any others. In order to do this, it is necessary that the stations are capable of receiving and processing the definition information, be it in the form of a definition file or in the form of an executable script or program which is generated at the management station. This in turn implies the presence of some form of management agent in the workstations, and a communications sub-system which can send to and receive transmissions from the management system, which itself will update its database to record any changes.

One example of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows a computer network;

Figure 2 shows a network management system employing the invention; and

Figure 3 is a flow diagram of an operation according to the invention.

Figure 1 shows a standard node computer network 10 which has plural interconnected user workstations 11. The workstations are managed from a main network management station 12.

The problem cited above of managing the workstations 11, can be seen in this context as one of updating (reading

from or writing to) database entries and as a consequence from/to the real workstation agents. When the numbers of workstations 11 start to become large (i.e. from many hundreds to tens of thousands) then, although powerful management systems 12 can access these volumes automatically, it becomes impossible for the human operator to search through such volumes and indicate which agents need to be contacted.

The answer to this is to break down this mass of nodes into groups and to manage the groups as if they were individual workstations. That is, an update to a group of (for example) parameter 5 on a group will cause the management system 12 to send an update order to all nodes contained in that group, for an update to parameter 5. Such groups are often called policy groups since all members are subject to the same management rules or policies.

The main difficulty then is in being able to define which groupings are significant and to define which of the (maybe thousands of) nodes should belong to which groups.

The method of the invention can be employed on network management systems 12 of the type managing the network 10 of figure 1. Such a system 12 is shown in figure 2 and generally consists of the following components:

1. A graphical user interface
2. A network Management control program(s)
3. A database (for registering network events and recording network component information).
4. A communications sub-system (for reading and updating network component status).

Of particular importance is the management database 3 which contains a data record for each of the devices 11 (nodes hubs routers etc.) which are to be found on the network 10. Typically a record will contain information such as the node's network address, its physical parameters and may also contain data related to its identification in the company's environment, such as who is the responsible user and where it is located. Database techniques are used

to manage this information on larger scale management systems because of the extent of the information, the numbers of nodes involved and the inter-relationships which may exist between co-operating network devices 11.

Manageable devices 11 are those end stations which can be interrogated and updated from the management system 12. This interrogation and updating is performed by sending messages (from the communications sub-system 4) to control programs (known as agents) which reside and are always active locally in the end stations 11. These agents are very common in network devices (such as bridges and routers) but are only just becoming available for user workstations.

The steps required for the implementation of the invention are shown in fig 3. The actions are initiated by a network administrator who will decide on the group membership conditions and configure his management station 12 accordingly (step 1). This is then compiled into scripts or programs (step 2) which are sent to all workstation agents on the network 10 (step 3). Note that normally there will be many group definitions active at any one time. At each workstation 11, on receiving a new group definition, the local agent will add it to his list of active group conditions and periodically will check the workstation 11 to see if any changes have taken place which affect the membership conditions (step 4). The rate at which this checking (polling) takes place is given by the script, since some conditions are more dynamic than others. A typical check on available disk space, for example, might be once every 15 seconds, whereas that for installed software need only be once every 10 minutes. Note that the agent will perform these checks independently of the workstation 11 being connected to the network 10, and will signal them as and when it is reconnected. This is particularly useful for portable PCs.

Whenever a change is detected which affects the membership of one or more defined groups, the agent causes

a trap message to be sent to the management station 12 to signal this event (step 5). This trap is used to update the database entries for each group and may also (optionally) generate an alarm condition for the administrator (step 6).

CLAIMS

1. A method of managing a plurality of computer workstations interconnected by a network, the workstations including at least one policy group, the method including the steps of:

receiving data relating to the policy group definition;

generating a program representative of the policy group definition data;

sending the generated program to each of the plurality of workstations;

instructing the workstations to check, by employing the program, whether or not each respective workstation belongs or does not belong to the at least one policy groups; and

returning the results of the checking step from each work station to at least one managing station.

2. A method according to claim 1, wherein the policy group definition data is received at a remote location.

3. A method according to claim 1 or claim 2, wherein the generated program is generated at a remote location.

4. A method according to any of claims 1 to 3, wherein the checking step is performed regardless of whether the workstation is connected to a network or not.

5. A method according to any of the preceding claims, wherein the generated program is altered in response to the returned results.

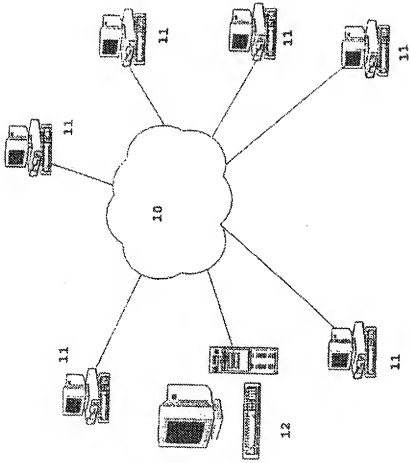

Fig 1

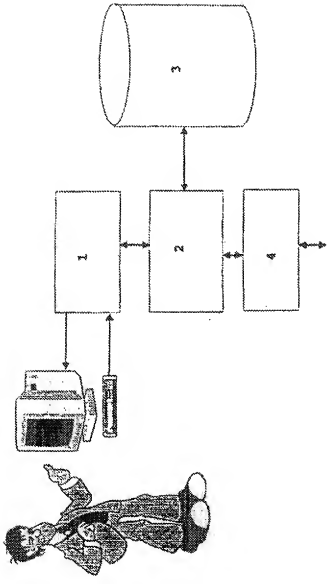

Fig2

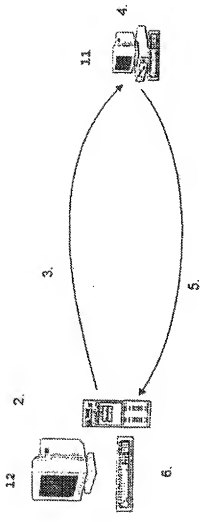

Fig3

INTERNATIONAL SEARCH REPORT

Inter. onal Application No
PCT/EP 97/04614

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L12/24

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	VASSILA A ET AL: "INTRODUCING ACTIVE MANAGED OBJECTS FOR EFFECTIVE AND AUTONOMOUS DISTRIBUTED MANAGEMENT" BRINGING TELECOMMUNICATION SERVICES TO THE PEOPLE - ISS & N 1995, THIRD INTERNATIONAL CONFERENCE ON INTELLIGENCE IN BROADBAND SERVICE AND NETWORKS, HERAKLION, CRETE, OCT. 16 - 19, 1995. PROCEEDINGS, no. CONF. 3, 16 October 1995, CLARKE A;CAMPOLARGO M; KARATZAS N (EDS), pages 415-429, XP000593492 see paragraph 1 see page 416, line 6 - line 18 see page 417, line 3 - line 13 see page 419, line 30 - line 40 see page 420, line 4 - line 8 see page 421, line 4 - line 17 see page 422, line 13 - line 15 --- -/--	1-5

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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18 November 1997	02/12/1997

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A	US 5 193 152 A (SMITH DANIEL L) 9 March 1993 see abstract; figures 3,4 see column 1, line 1 - column 2, line 68 see column 5, line 11-58	1,2
A	US 4 385 384 A (ROSBURY ARTHUR H ET AL) 24 May 1983 see abstract; figure 2 see column 6, line 15-43 see column 9, line 67 - column 10, line 38 see claims 1,2	1-3
A	MITROPOULOS S ET AL: "INTEGRATED DISTRIBUTED MANAGEMENT IN INTERCONNECTED LANS" PROCEEDINGS OF THE NETWORK OPERATIONS AND MANAGEMENT SYMPOSIUM (NOM, KISSIMMEE, FEB. 14 - 17, 1994, vol. 3 OF 3, 14 February 1994, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 898-908, XP000452396 see page 900, line 1 - last line see page 904, line 1 - page 905, last line	1
A	CHERITON D R ET AL: "HOST GROUPS: A MULTICAST EXTENSION FOR DATAGRAM INTERNETWORKS" HIGH PERFORMANCE LIGHT-WEIGHT FUEL CELL ELECTRODES, 10 September 1985, pages 172-179, XP000560608 see abstract see paragraph 2 - paragraph 2.1	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter. onal Application No
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